
Job name: Ford Airfield

Job No: C85228

Note No: C85228-JNP-92-XX-RP-C-1004

Date: 09/07/2021

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Subject: Ford Airfield – Updated outline planning drainage strategy following meeting Arun District Council (ADC) Drainage Department on Tuesday 25 May 2021

1. Introduction

- 1.1 JNP Group has been liaising with the ADC Drainage Engineers regarding the drainage strategy for the Ford Airfield development since 2019. The original Flood Risk Assessment and Drainage Strategy Report was submitted in February 2020. Since then, we have carried out further site investigation and testing and provided several update reports and revisions of the drainage strategy.
- 1.2 We have discussed and exchanged correspondence with the ADC Drainage engineers which highlight the constraints and challenges which impact upon the development. As a result, ADC has clarified an approach to be implemented which will satisfy requirements for outline planning.
- 1.3 This technical note addresses the recent comments raised by ADC and demonstrates the drainage strategy has been amended to meet ADC's requirements.

2. Northern Parcel, North-West Parcel and Employment Zone

- 2.1 JNP Group (JNP) previously issued Technical Note ref C85228-JNP-92-XX-RP-C-1001 titled Addendum to the Flood Risk Assessment and Drainage Strategy Note dated 14 January 2021.
- 2.2 The technical note provided an updated drainage strategy for the Ford Airfield development following supplementary soakaway soil infiltration rate testing and groundwater level monitoring carried out over the winter 2019 /2020. In summary, the revised drainage strategy, in the north of the development, recommended by JNP comprised of:
 - Northern Parcel - Parcel SuDS with overflows/ connections to a piped sewerage system which discharges to an infiltration basin.
 - North West Parcel - Parcel SuDS with overflows/ connections to a piped sewerage system which discharges to an infiltration basin.
 - Employment Zone – Infiltration drainage and soakaways

- 2.3 The proposed solutions for these parcels are shown on Drawing No. C85228-D100 Indicative Surface Water Drainage Strategy Sheet 1 of 2, provided in Appendix A. Calculations have also been previously provided to ADC to support the designs provided.
- 2.4 JNP provided further information to support the direction of groundwater flow in Technical Note ref C85228-JNP-92-XX-RP-C-1003 titled Ford Airfield - Outline planning drainage strategy update and topics for further discussion with Arun District Council (ADC).
- 2.5 This was discussed with ADC during the meeting held on 25 May 2021. It was agreed that the information provided supports the use of infiltration drainage in the Northern Parcel, North-West Parcel and Employment Zone.
- 2.6 We agreed that water quality improvement would be addressed by providing permeable paving and a sediment forebay as part of the infiltration basin design and this would form part of reserved matters design.
- 2.7 ADC also required additional winter soakaway and groundwater level monitoring to be carried out at the proposed location of the infiltration basin.
- 2.8 It was agreed the infiltration solutions provided for the north of the site are satisfactory to grant outline planning.

3. Southern Parcel, Southwest Parcel and Southeast Parcel – Recent Liaison with ADC

- 3.1 The winter site investigation results showed that the south of the site cannot not be served by infiltration drainage or soakaways. Some areas, estimated at 25% of the southern site area, allowed some infiltration, with very slow infiltration rates. It was agreed that overflows from infiltration systems, into a positive drainage system, would be required during more severe storm events.
- 3.2 JNP's original strategy for the south of the development site comprised of:
 - Southern Parcel - Parcel SuDS with overflows/ connections to a sewerage system which discharges to an attenuation basin and pumping station which discharges into a watercourse
 - South West Parcel - Parcel SuDS with overflows/ connections to a sewerage system which discharges to an attenuation basin and a gravity sewer which discharges into a watercourse
 - South East Parcel - Parcel SuDS with overflows/ connections to a sewerage system which discharges to underground storage and a gravity sewer which discharges into a watercourse
- 3.3 ADC had previously advised that surface water pumping is not preferred and should be the option of last resort. JNP agree with this approach but raised concerned regarding the high groundwater levels recorded in the south and southwest of the development site and locating lined attenuation features in these areas.
- 3.4 The meeting held on 25 May provided the opportunity to raise concerns regarding the different

drainage strategy approaches. ADC highlighted the challenges they had faced previously with pumped drainage systems on different schemes. This has partly led ADC to promote and support drainage schemes which provide shallow conveyance drainage and lined open SuDS features. As a result of flat topography and high groundwater in many areas across the region, ADC have examples where this approach has been implemented to avoid surface water pumping.

- 3.5 JNP raised a number of questions which were discussed during the meeting. ADC clarified their responses by email, dated 27 May, following the meeting.

Ref	JNP Query	ADC Response
1	Please would ADC confirm that it considers lining the ditches and basins reasonable and robust approach for this large development based on the high groundwater levels recorded?	We confirm that we are happy for lining to be used where required. This approach is used widely in the area. As previously discussed, the use of infiltration should be maximised. Where adequate storage cannot be located above peak groundwater level impermeable liners will be required. The use of liners will be reviewed on a location-by-location basis.
2	Please advise if ADC agree that the winter soakaway results show that infiltration solutions are not viable in the areas indicted by the red circles in Figure 5.	As discussed, we will expect more infiltration testing to be completed at later stages to ensure that infiltration is used to the maximum possible extent.
3	Other than using tanked permeable paving to collect and convey surface water runoff across the parcels, what other conveyance methods would be suitable, which do not result raising ground levels?	This is a designer's issue. As previously stated, we frequently see shallow conveyance in the form of permeable paving and swales
4	Does the lined basin and shallow conveyance features drainage strategy suggestion allow for adoption? Please can ADC provide assurance that it will adopt the shared SuDS features, particularly where Southern Water are unable to do so?	As discussed, ADC do not typically adopt SuDS features. At a later stage we can provide costs for what committed sum would be required going forward if the applicant wishes to explore this option.
5	Does WSCC adopt tanked permeable paving and, if not, what other adoptable road solutions can be used across the parcels where surface water runoff cannot infiltrate directly into the ground?	I have enquired with WSCC and they have confirmed that they do not currently adopt tanked permeable paving. The degree of roads for adoption can be discussed at later stages. It is typical on large developments that often only the spine roads are adopted.

6	To avoid raising ground levels across the parcels is ADC suggesting that all primary and secondary road should discharge surface water into an adjacent ditch? Where a ditch cannot be provided drainage connections by sewers under the road and applying a longitudinal fall over the surface would increase ground levels within parcels.	This is a designer's issue. We believe that gravity conveyance of surface water via shallow features will be achievable to a greater extent here.
7	Based on the lined basin and shallow conveyance features drainage strategy, in conjunction with permeable paving and high-level overflows, how does this provide for the adoption of main drainage systems and who will adopt them?	This is the applicant's issue. The argument regarding adoption is not seen as sufficient to preclude the use of standard gravity suds features. There is always an option to have a maintenance company, which the vast majority of major housebuilders tend to use.

4. Southern Parcel, Southwest Parcel and Southeast Parcel – Updated Drainage Strategy

- 4.1 Based on the comments raised by ADC the surface water drainage strategy for the south of the site has been updated to remove surface water pumping.
- 4.2 The following updated drainage strategy drawings are provided in Appendix B:
 - C85228-SK194 Southern Parcel Underdrain Swale Strategy
 - C85228-SK193 Underdrain Swale Typical Sections
- 4.3 We highlight the following features of the proposed design which achieve ADC requirements for outline planning.
- 4.4 The south of the site is no longer considered as 3 parcels with separate drainage systems.
- 4.5 The south of the site discharges to 2 no. existing watercourse to the southwest of the site which are adjacent to the Yapton Road. The watercourse are both tributaries of the Ryebank Rife.
- 4.6 The watercourse are located at the lowest lying ground levels onsite.
- 4.7 The proposed drainage strategy comprises of 2 no. surface water catchments which discharge to separate outfalls at each watercourse.
- 4.8 Lined attenuation basins are provided just upstream of each outfall. The flow offsite via each outfall is restricted to Greenfield runoff rate, calculated based on the proposed impermeable area of the development, which discharges to each outfall. An allowance for urban creep has been included to calculate the volume of the basins.
- 4.9 The outfall pipe from the flow control device discharges by gravity to the watercourse. The invert level at the outfall to the watercourse is set approximately 300mm above the bed level of the

watercourse. This provides an adequate depth of cover where the sewer connections cross Yapton Road.

- 4.10 It is estimated the lined attenuation basins will be in the region of 1.5 to 1.8m deep including an allowance for freeboard. The variance in the depth of the basin is a result of the natural fall across the existing site. It will not be necessary to significantly raise ground levels around the basins which are located at the edge of the development along an existing boundary with the public highway.
- 4.11 Preliminary drainage calculations have been carried out, using Micro Drainage, to access the size and capacity of the lined basins and ditches for the 1 in 100 year + 40% CC event. This includes a degree of “stress” testing to consider the impact of surcharged outfalls at the watercourse and providing short sections of culverted pipe to represent road crossings etc. However, the arrangement of the parcels is still under development and further interactions of the calculations will be required.
- 4.12 Our preferred method to convey surface water runoff from the development parcels to the attenuation basins is to use underdrain swales.
- 4.13 This is a 600 mm diameter perforated pipe with an open graded stone surround and an overlying swale. In low flow conditions surface water will discharge into and flow through the pipe. During more severe storm events the water will surcharge the pipe and fill the swale. Refer to the indicative detail drawings provided in Appendix B.
- 4.14 We have carried out calculations to assess the typical size of the underdrain swale. Further calculations will be undertaken to confirm requirements as the design progresses.
- 4.15 The perforated pipe will be laid with a 1 in 500 minimum gradient.
- 4.16 We estimate the underdrain swale will be between 7.0m and 12.0m wide (includes 1.0m shoulder at either side). The final width depends on the height and level of the road / ground adjacent to the swale which will vary depending on the road and landscaping design. We estimate the depth of the swale will be between 0.6m to 1.5m deep.
- 4.17 The perforated pipe will be a minimum of 1.5m deep and allows for parcel drainage networks to connect at the invert of the perforated pipe.
- 4.18 The indicative routing of the underdrain swales, at this stage, are shown in Appendix B. The routes have been assessed to provide multiple options for incoming connections from the development parcels. This will reduce the length of the surface water networks within the development parcels and will provide shallow and efficient drainage systems. The final routing will be determined at reserved matters stage.
- 4.19 The shape, size and location of the basins and underdrain swales are indicative and are subject to further design to ensure landscape and ecological benefits.

5. Further Development of the Drainage Strategy Design

Northern Parcel, North-West Parcel and Employment Zone

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- 5.1 Extensive soakaway testing and groundwater monitoring was carried out in Winter 2019/20, over an unusually wet period. This data enables us to focus more on the parcels, within parts of the site, which may permit infiltration drainage directly into the ground. Additional winter soakaway testing and groundwater will be carried out where the current data suggest infiltration is viable.
 - 5.2 ADC has advised that where infiltration rates of $1 \times 10^{-6} \text{m/s}$ and above, infiltration shall be used to the fullest extent possible.
 - 5.3 Additional winter soakaway testing and groundwater monitoring will be carried out at the location of the infiltration basin.
 - 5.4 SuDS will be provided within the northern parcels. This will mainly comprise of either infiltration or tanked permeable paving. Overflows from these systems will connect into the underground piped sewerage system which conveys surface water runoff to the infiltration basin.
 - 5.5 Typically, the pipe sewerage system meets the requirements for adoption by wastewater services providers, subject to final agreement. This would also allow the roads in the north of the site to be adopted by the local Highways authority.
 - 5.6 It is proposed the infiltration basin remains private and is maintained by a management company. This would allow a deed of discharge agreement between the owner of the infiltration basin and the wastewater services provider.

Southern Parcel

- 5.7 As described above additional winter soakaway testing and groundwater monitoring will be carried out onsite where the current data suggests infiltration is viable. The testing may extend these areas and increase the potential for discharging water directly into the ground.
- 5.8 Regardless of this a second drainage system is required to receive water via high level overflows from the infiltration systems during a severe storm event.
- 5.9 It is expected that the majority of the southern parcel will not be suitable for infiltration. We will therefore design SuDS which capture the water at source, reduce the rate of discharge and provide water cleansing, where possible, such as tanked permeable paving.
- 5.10 The existing topography of the southern parcel is gently sloping to flat. To reduce unnecessary raising of ground levels across the site we will aim to use shallow drainage systems to convey the flows, such as tanked permeable paving, Aco channel drains, or similar, and shallow swales will be considered. Sewer and box culverts are not ruled out, if used with techniques which reduce the depth of cover of backfill material. All techniques will need to be carefully considered where there is a risk of raised groundwater to prevent water ingress and buoyancy.
- 5.11 The use of non-typical drainage techniques and high groundwater could impact on adoption of the drainage infrastructure by wastewater services providers. In addition, this could rule out the road networks for adoption by the Highways authority.
- 5.12 Based on the size and complexity of this scheme the developers and their consultants propose to work closely with ADC and West Sussex County Council to identify opportunities and agreements that enable adoption of the primary shared infrastructure by the local authority. This will form a

consideration for any detailed design at reserved matters stage.

Offsite Highway Works at the Entrances to the Development

- 5.13 Two new roundabouts, to serve the new development, are proposed off Yapton Road and Ford Lane.
- 5.14 Based on the winter site investigation data the Ford Lane roundabout will discharge into a soakaway provided within the central island and other infiltration drainage features.
- 5.15 The Yapton Road roundabout will be served by a separate highways drainage system and attenuation basin, provided within the site boundary. The water will discharge to the nearby watercourse outfall adjacent to Yapton Road. The discharge flow will be restricted to Greenfield runoff rate.

6. Conclusions

- 6.1 The north of the development site will discharge surface water runoff into the ground by infiltration as follows:
 - Northern Parcel - Parcel SuDS with overflows/ connections to a piped sewerage system which discharges to an infiltration basin.
 - North West Parcel - Parcel SuDS with overflows/ connections to a piped sewerage system which discharges to an infiltration basin.
 - Employment Zone – Infiltration drainage and soakaways
- 6.2 The southern parcel will discharge surface water to 2 no. watercourses in the southwest of the development which are located adjacent to the Yapton Road. The discharge flows from the development will be restricted to Greenfield runoff rate and attenuation basins will be provided close to the outfalls.
- 6.3 It is proposed the surface water runoff will be conveyed to the attenuation basins using a primary network of underdrain swales which enable the water to flow by gravity.
- 6.4 The underdrain swales are efficient in terms of depth and width and provide advantages over using deeper open ditches.
- 6.5 Shallow drainage systems and SuDS will be provided, where possible, within the development parcels which will reduce raising finished ground levels across the site, which is currently gently sloping and flat in some areas.
- 6.6 The drainage strategy information provided in this technical note demonstrates that a viable solution has been considered in sufficient detail grant outline planning. The proposals can now be agreed to avoid further optioneering or strategy amendments. Work continues to develop the design in more detail and JNP intend to continue to work closely with ADC during approval of reserved matters.

6.7 Draft condition to secure detailed drainage strategy:

It is proposed that there will be an overarching phasing condition/obligation that requires submission of a phasing strategy, to include the drainage implementation strategy. In this context, the following drainage condition is proposed to agree the detailed drainage strategy per phase of the development.

Prior to the commencement of each phase of development (excluding demolition) as defined within the [Phasing Strategy], the detailed drainage strategy for that phase shall be submitted to and approved by the council, in broad accordance with the principles set out in the Drainage Technical Note (ref: C85228-JNP-92-XX-RP-C-1004) dated 9 July 2021 unless otherwise agreed in writing by the council.

Document Issue Record

Technical Note No	Rev	Date	Prepared	Reviewed	Approved
C85228-JNP-92-XX-RP-C-1004	P01	09.07.21	AM	AB	AB

List of Appendices

<i>Appendix A</i>	<i>Northern Parcels Drainage Strategy</i> <i>C85228-D100 Indicative Surface Water Drainage Strategy Sheet 1 of 2</i>
<i>Appendix B</i>	<i>Southern Parcels Drainage Strategy</i> <i>C85228-SK194 Southern Parcel Underdrain Swale Strategy</i> <i>C85228-SK193 Underdrain Swale Typical Sections</i>

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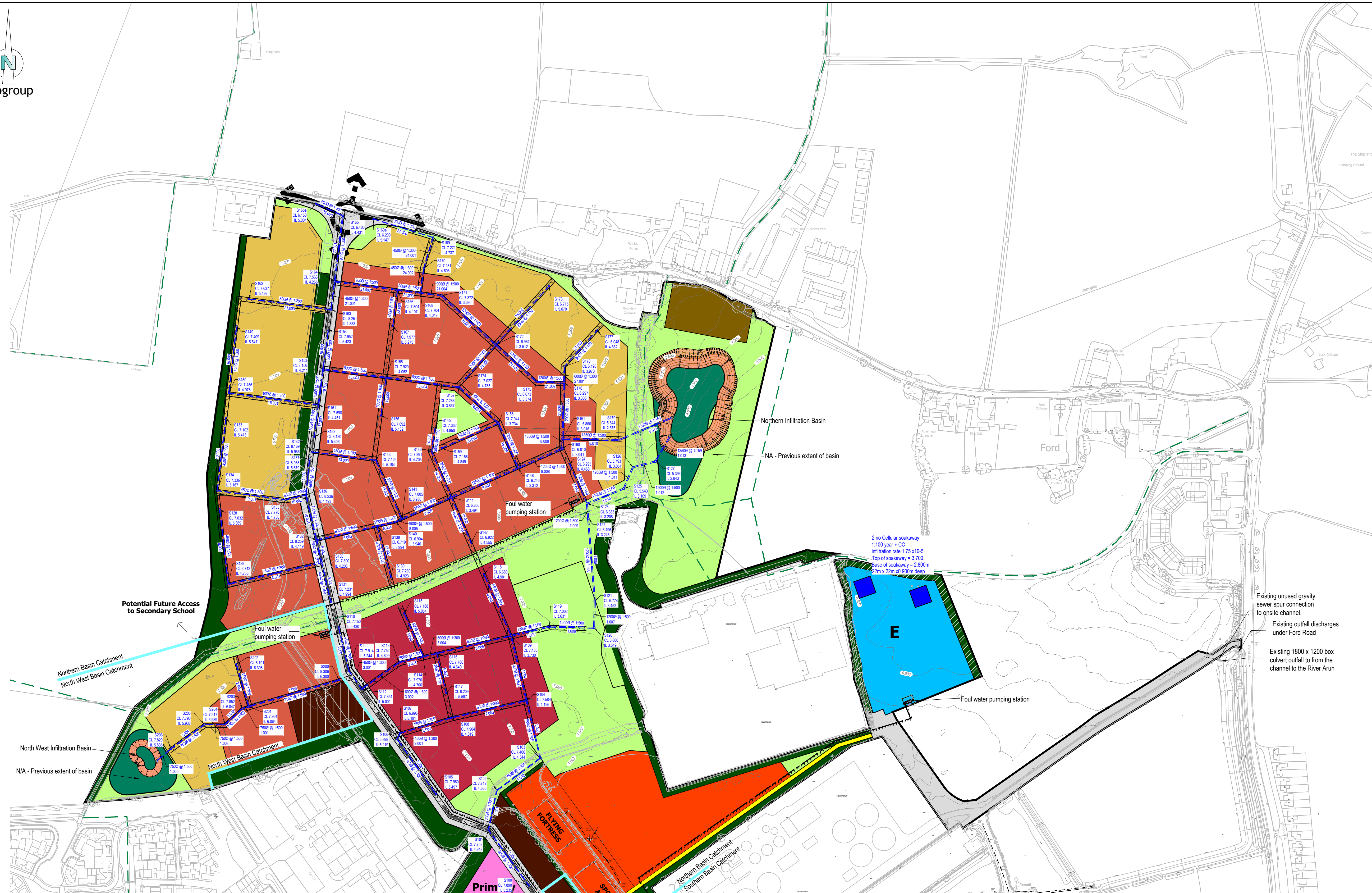
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Appendix A

Northern Parcels Drainage Strategy



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Legend

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Note:

The size, shape and location of the basins and underdrain swales are indicative and are subject to further design to ensure landscape and ecological benefits. This will be carried out for detailed approval on a phase by phase basis at reserved matters stage.

G	12.07.21	Viewport revised	IS	AI
F	10.12.20	Surface Water Networks updated to provide infiltration	IS	AI
E	10.02.20	Surface Water networks updated to include offsite highways works. Basins revised due to groundwater monitoring results	IS	AI
D	19.12.19	Site boundary revised	IS	AI
C	24.10.19	Land use plan updated	IS	AI
B	11.07.19	Surface water networks revised, Foul pump station and risings mains revised, Site layout updated	IS	AI
A	09.05.19	Surface water networks and basins revised	IS	AI
Rev.	Date	Amendment	By	Ch

Status	Indicative
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Client	Wates Redrow
Job	Ford Airfield
Title	Indicative Surface Water Drainage Strategy Sheet 1 of 2

Scale 1:2500		@ A1	Date February 2019
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Drawing No. C85228-D100	Rev
	G